Observations on the ecology of the Barking Owl *Ninox connivens* within the lower Macquarie River floodplain of New South Wales

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ABSTRACT

Sixteen Barking Owl *Ninox connivens* records, accounting for 29 birds were made by Department of Infrastructure, Planning and Natural Resources (DIPNR) staff from 1996-2004 within the lower Macquarie River floodplain in New South Wales. Records suggest a strong association between owl presence and riparian River Red Gum *E. camaldulensis* forest / woodland. Nearest neighbour distances between records were similar to those found elsewhere on the NSW central west slopes and plains.

Key words: Barking Owl, habitat associations, territory, threatened species.

Introduction

The Barking Owl *Ninox connivens* is listed as a Vulnerable Species under Schedule 2 of the New South Wales *Threatened Species Conservation Act 1995*. Nationally, the species is not listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. However, Garnett and Crowley (2000) list the southern sub-species *N. c. connivens* (that occurring in NSW) as Near Threatened using IUCN criterion a – *Reduced area of occupancy and/or extent of occurrence: Taxa that have disappeared from over 50% of their former area of occupancy and/or extent of occurrence and are at risk of further decline.*

A review of the literature and some recent extensive surveys indicates the species is widely distributed within NSW, but is usually recorded at low levels of abundance (Debus 1997; Garnett and Crowley 2000; NPWS 2002; RACD 2002). The majority of records of the species seem to be from the western slopes of the Great Dividing Range (Debus 1997), with the only known stronghold of the species occurring in Pilliga West State Forest where there are at least 30 pairs (Milledge 2004; RACD 2002).

The relatively low number of records of *N. connivens* from the western plains, however, suggest the species is under-represented and this could be linked to the relatively high degree of land clearing that has occurred (Kavanagh *et al.* 1995; Debus 1997). Habitat loss is regarded as a major threat to *N. connivens* populations in NSW (Smith *et al.* 1995; NPWS 2003). Recent large-scale bioregion surveys have recorded only a few sightings of the owl, mostly allied to riparian vegetation across western NSW (NPWS 2002; RACD 2002). Therefore, it is highly desirable to obtain ecological information from records on the plains of NSW where the species is seemingly under greatest threat. The aim of this paper is to provide information on the owl gleaned from a number of surveys targeting one such area of the western plains, that of the lower Macquarie River floodplain.

Methods

Sixteen *N. connivens* records, accounting for 29 birds, have been made by DIPNR staff from 1996-2004 during the course of either systematic vertebrate animal surveys, or opportunistically when on short-term fieldwork or while on recreational activities (camping, hunting, fishing).

Owl survey techniques utilised in systematic fauna surveys were timed spotlight searches (30 minutes around each trapping site) and the use of owl call playback (two, five minute call sequences) with associated spotlight checks (five minutes between playbacks) between calls to detect birds that may have approached silently. All opportunistic records were made by either hearing unsolicited calls or by actual sightings. In two systematic survey cases, unsolicited calls were detected prior to the commencement of spotlighting or call playback.

At each site, the vegetation type was noted. For example, in Table 1, River Red Gum *Eucalyptus camaldulensis* forest and/or woodland refers to a *E. camaldulensis* - community that has little to no shrub layer and a variable understorey typically dominated by Cooba *Acacia salicina* or River Cooba *Acacia stenophylla.* River Red Gum / Cumbungi *Typha* sp. and River Red Gum / Lignum *Muehlenbeckia florulenta* designate *E. camaldulensis* communities that have little understorey, but dense shrub layers of one particular species. Thus, each vegetation type, while still an *E. camaldulensis* community, is visibly different from each other.

Results

Records were collected between 1996-2004 from 10 properties located within the lower Macquarie River floodplain downstream from Warren to the junction of the Macquarie and Darling Rivers in central west NSW. Figure 1 depicts the location of owl sightings and those sites within the floodplain where no owls were detected.

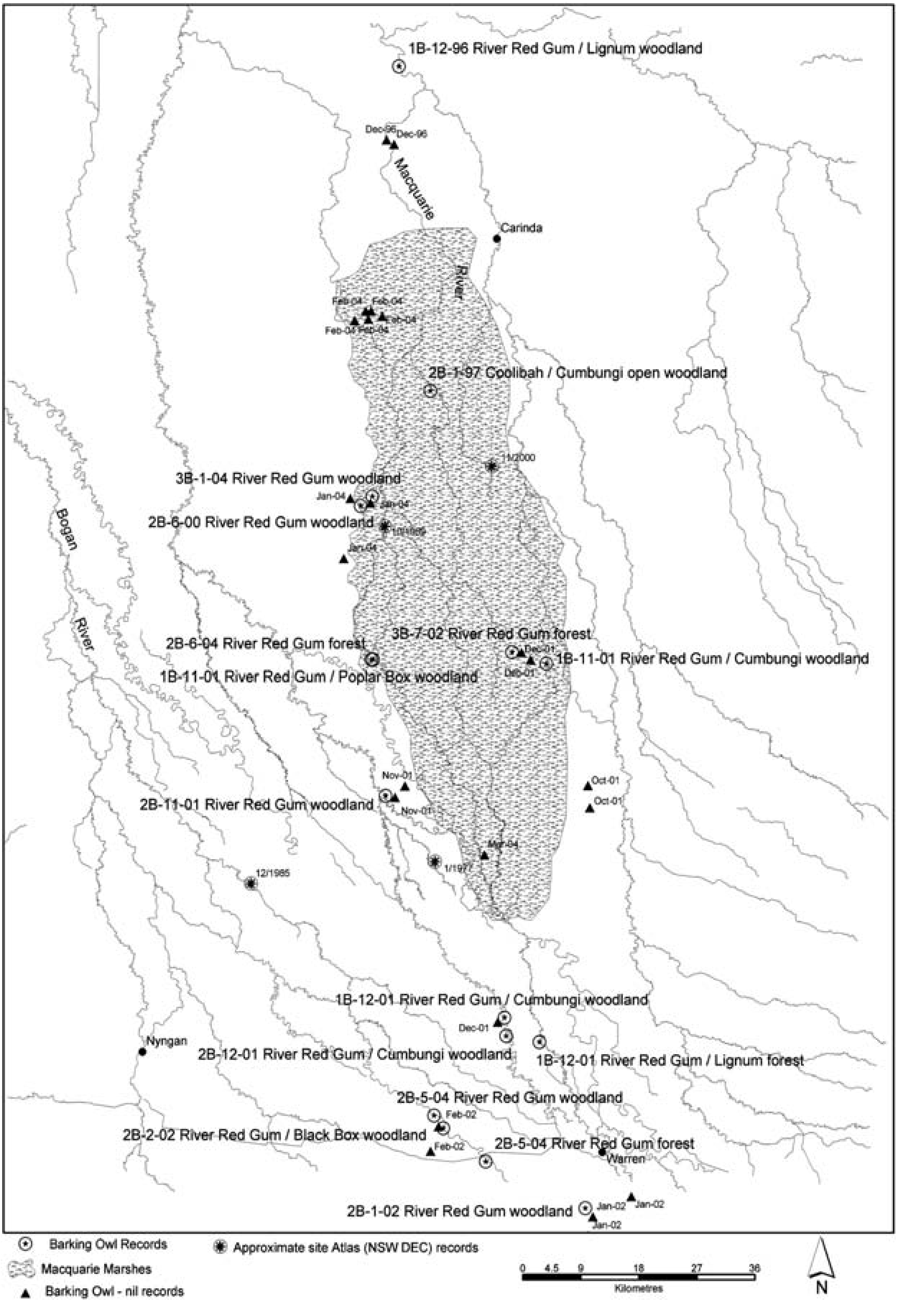
1B-12-96 River Red Gum / Lignum woodland
Dec-96
Dec-96
Macquarie
River
Carinda
Feb-04
Feb-04
Feb-04
Feb-04
Feb-04
2B-1-97 Coolibah / Cumbungi open woodland
1/2000
3B-1-04 River Red Gum woodland
Jan-04
Jan-04
2B-6-00 River Red Gum woodland
10/1985
Jan-04
Bogan
River
3B-7-02 River Red Gum forest
2B-6-04 River Red Gum forest
Dec-01
1B-11-01 River Red Gum / Cumbungi woodland
Dec-01
1B-11-01 River Red Gum / Poplar Box woodland
Nov-01
Oct-01
Oct-01
2B-11-01 River Red Gum woodland
Nov-01
Mar-04
1/1977
12/1985
1B-12-01 River Red Gum / Cumbungi woodland
Dec-01
Nyngan
2B-12-01 River Red Gum / Cumbungi woodland
1B-12-01 River Red Gum / Lignum forest
2B-5-04 River Red Gum woodland
Feb-02
2B-2-02 River Red Gum / Black Box woodland
Feb-02
2B-5-04 River Red Gum forest
Warren
2B-1-02 River Red Gum woodland
Jan-02
Jan-02
Jan-02
Barking Owl Records
Approximate site Atlas (NSW DEC) records
Macquarie Marshes
Barking Owl - nil records
0
4.5
9
18
27
36
Kilometres
N

Figure 1. Location of Barking Owl *Ninox connivens* records and survey sites within the lower Macquarie River floodplain.

Table 1. Number of birds observed, location, vegetation type and survey type recorded at each site within the lower Macquarie River floodplain.

Barking Owl Record Tag	Easting	Northing	Vegetation type	Survey type
1B-12-96	552100	6654900	River Red Gum / Lignum woodland	Opportunistic
2B-1-97	556100	6606500	Coolibah / Cumbungi open woodland	Opportunistic
2B-6-00	546700	6589400	River Red Gum woodland	Opportunistic
1B-11-01a	571300	6565750	River Red Gum / Cumbungi woodland	Systematic
1B-11-01b	566750	6567500	River Red Gum / Poplar Box woodland	Systematic
2B-11-01	549800	6546300	River Red Gum woodland	Systematic
1B-12-01a	565400	6513100	River Red Gum / Cumbungi woodland	Systematic
1B-12-01b	570000	6509450	River Red Gum / Lignum forest	Systematic
2B-12-01	565600	6510400	River Red Gum / Cumbungi woodland	Systematic
2B-1-02	575900	6484650	River Red Gum woodland	Systematic
2B-2-02	557200	6496700	River Red Gum / Black Box woodland	Systematic
3B-7-02	548000	6566500	River Red Gum forest	Opportunistic
3B-1-04	548250	6590800	River Red Gum woodland	Systematic
2B-5-04a	556000	6498600	River Red Gum woodland	Systematic
2B-5-04b	562800	6491700	River Red Gum forest	Opportunistic
2B-6-04	548250	6566500	River Red Gum forest	Opportunistic

Of the 16 records, eight (50%) were from birds responding to nocturnal call playback of *N. connivens* during vertebrate fauna surveys, six records (38%) were of owls heard calling and two records (12%) were of owls initially sighted. Five records (31%) were of individuals, nine (56%) were of two owls, and two (13%) were of three owls.

Table 1 provides the location of each owl record within the floodplain. The identification tag designates the number of owls present and the month and year recorded. For example, 2B-1-02 refers to two *N. connivens* recorded in January 2002.

Table 2 provides the location of sites and the vegetation types within the floodplain where no owls were recorded. The systematic survey sites listed gave no owl response to call playback and spotlight searches. Opportunistic sites comprised overnight stays with no unsolicited calls. In two cases, call playback was conducted at opportunistic sites without response.

Habitat notes

Fifteen records (94%) were from *E. camaldulensis* forest / woodland or its associations (Table 1). The remaining record was a pair of owls observed flying from *E. camaldulensis* woodland to hunt in the immediately adjacent *E. coolabah* vegetation. These owls were not responding to call playback. While nearly all records were within *E. camaldulensis* communities, there was considerable variation in the associated understorey species. Eight records (50%) had an acacia understorey (*A. salicina, A. stenophylla*) and limited shrub layer; four records (25%) a dense *Typha* sp. understorey, two records (13%) a dense M *florulenta* shrub layer; one record (6%) associated with Black Box *E. largiflorens* and one record (6%) associated with Poplar Box *E. populnea*.

Fifteen records (94%) of *N. connivens* were made either on the banks of creeks or from the Macquarie River itself, within one kilometre of a watercourse, or adjacent to a wetland. Only one record was of an owl located approximately four kilometres from the nearest watercourse. This was, however, in an area that relies on floodplain inundation to keep the *E. camaldulensis* healthy.

No owls were recorded from an additional 24 sites, covering 10 broad vegetation types (Table 2). The most frequently surveyed vegetation type, from sites with no owl detection, was *E. populnea* woodlands (seven sites). Three sites were from *E. camaldulensis* woodlands, the habitat where nearly all owl records were made. Open habitat types such as reedbeds, *M. florulenta* shrubland and grasslands / low shrublands usually contained isolated trees that could be utilised by owls as hunting perches, and therefore were included as potential habitat types. The vegetation types surveyed represent the majority of the vegetation associations present on the lower Macquarie River floodplain according to NPWS vegetation mapping of the Lower Macquarie – Castlereagh region by Kerr *et al.* (2003) (Table 3). However, the broad vegetation type (BVT) mapped by NPWS as covering the largest area on the lower floodplain was not surveyed (Table 3). This mixed box / western rosewood open woodland with chenopod understorey as listed by Kerr *et al.* (2003) is described as being mixed *E. populnea* / *E. largiflorens* that also is associated with *Casuarina cristata* and *E. coolibah*. Therefore, some survey sites described as *E. populnea* or *E. largiflorens* vegetation types in this survey would have occurred within this mapped BVT.

Noted roost trees

One record was made of roosting owls. Record 1B-12-96 was of a single owl observed high up in the canopy of a large *E. camaldulensis* on the bank of the Macquarie River.

Table 2. Location, vegetation type, survey type and date at each site within the lower Macquarie River floodplain where no *Ninox conniven* were recorded.

Easting	Northing	Vegetation type	Survey type	Date
550300	6643800	River Red Gum / Black Box	Systematic	Dec 1996
551300	6643100	Coolibah / Lignum	Systematic	Dec 1996
576850	6544200	White Cypress	Systematic	Oct 2001
576600	6547500	Poplar Box / White Cypress	Systematic	Oct 2001
552300	6547600	Poplar Box / Wilga	Systematic	Nov 2001
550950	6545900	Myall	Systematic	Nov 2001
564400	6512300	Poplar Box / White Cypress	Systematic	Dec 2001
567900	6567300	Poplar Box	Systematic	Dec 2001
569100	6566200	grassland / isolated River Red Gum	Opportunistic	Dec 2001
576200	6480400	Poplar Box / White Cypress	Systematic	Jan 2002
581900	6486200	grassland / isolated River Red Gum	Systematic	Jan 2002
576800	6483200	Myall	Opportunistic	Jan 2002
555400	6493100	Poplar Box / White Cypress	Systematic	Feb 2002
556500	6496800	Black Box	Systematic	Feb 2002
547900	6589650	Phragmites / Cumbungi	Systematic	Jan 2004
545200	6590350	Lignum	Systematic	Jan 2004
544300	6581400	Leopardwood	Systematic	Jan 2004
545900	6616900	Coolibah	Systematic	Feb 2004
548100	6618300	Lignum	Systematic	Feb 2004
549600	6617500	grassland / low shrubland	Systematic	Feb 2004
550500	661800	River Red Gum	Opportunistic	Feb 2004
547400	6618300	River Red Gum / Lignum	Opportunistic	Feb 2004
547750	6617100	Coolibah / Lignum	Opportunistic	Feb 2004
562800	6537300	Dwyer's Red Gum / Poplar Box	Opportunistic	March 2004

Table 3. Distribution of owl survey sites within the lower Macquarie River floodplain according to the extent of mapped broad vegetation types (adapted from Kerr *et al.* 2003).

Broad Vegetation Type Name	Area (ha)	% each BVT	No. survey sites
Mixed Box / Rosewood open-woodland with chenopod understorey	107549	22.5	0
Poplar Box associations	83309	17.4	7
Black Box open-woodland on grey alluvial clays	68509	14.3	2
River Red Gum associations	64738	13.5	17
Plains Grass grassland on loamy flats	43176	9	3
Saltbush low open-shrubland on alluvial flats	42808	8.9	0
Coolibah open-woodland on grey cracking clays on alluvial plains	24661	5.2	4
Wetlands on grey clay floodplain depressions and watercourses	17609	3.7	1
Myall tall open-shrubland on loamy-clay plains	10429	2.2	2
Belah open-woodland on brown clay flats	5831	1.2	0
Leopardwood tall open-shrubland on alluvial plains	5696	1.2	1
Mitchell Grass grassland on sandy clay plains	3395	0.7	0
Brigalow open-woodland on undulating sandplains and alluvial plains	237	0.1	0
Lignum shrubland on grey clay floodplains	456	0.1	2
Tumbledown Red Gum / Poplar Box woodland on granite outcrops	313	0.1	1

Predation events

Three observations were made of *N. connivens* taking prey. Record 1B-12-96 (assumed to be the same bird noted roosting) was of an individual owl that hunted from the roof of shearer's quarters and an adjacent shearing shed on two consecutive nights. The first night the owl attacked and fought with a Feral Cat *Felis catus*, probably from a half grown litter in the adjacent woolshed, for over five minutes before subduing it enough to carry it away towards the Macquarie River some two kilometres away. On the next night a Rabbit *Oryctolagus cuniculus* was taken. Identification of the prey was made by their distress calls. Record 2B-1-97 was of a pair of owls that flew out of *E. camaldulensis* woodland into an open woodland of scattered large *E. coolabah* and standing dead timber. These owls paid no attention to our campsite with neon lighting under a tree 20 metres from their selected perch. Both owls were observed flying to the ground and bringing House Mouse *Mus musculus* back to the perch.

Nearest neighbour distances

Due to the predilection of *N. connivens* to respond over long distances to taped calls, nearest neighbour distances were only determined where more than one owl record was made on the same night or by observations of the same owls over consecutive nights. Such observations allow for an estimate of the area of habitat that the birds ranged over.

From the sixteen owl records made, five determinations of nearest neighbour distance can be inferred.

1. Record 2B-1-02 – Two owls were heard calling from along a two kilometre stretch of Sandy Creek over several consecutive nights. Sometimes the birds were together, sometimes hundreds of metres apart. In this case, 2 km was considered the maximum length of creek within the territory.
2. Record 2B-5-04 – In May 2003, property employees conducted a call playback survey and recorded two owls on this location (same as our record), then recorded another pair approximately 3 km downstream on the same creekline (Sandy Creek).
3. Two records 1B-11-01a and 1B-11-01b – A distance of approximately 5 km was found between an owl recorded on Gum Cowal and another in *E. camaldulensis* / *E. populnea* mixed woodland on the same night.
4. Record 1B-12-96 – An individual owl hunted from the roof of shearer's quarters and adjacent shearing shed on two consecutive nights. The buildings were located in *E. largiflorens* open woodland approximately 2 km from the Macquarie River and the point of observation of a roosting bird. Distressed prey calls were heard as the owl carried prey back towards the river so the assumption is that the roosting bird was utilising the buildings. Thus, the 2 km distance was within its territory on one side of the river.
5. Records 2B-12-01, 1B-12-01a and 1B-12-01b – Three owl locations were recorded on the same property, two on the same night and one on the next night. A distance of 4.5 km separated an individual owl on the Macquarie River from two owls located near shearer's quarters on Crooked Creek. Approximately 3 km separated the two owls near the quarters from a single owl further downstream on same creek.

Behaviour Notes

Observations suggest that *N. connivens* is a very vocal owl species with unsolicited calls being heard just on dark (records 2B-5-04, 2B-6-00), throughout the night (records 2B-11-01, 3B-7-02) and just before dawn (record 2B-6-04). The pair calling just before dawn seemed to be for the birds to locate each other to roost as the calls over time came closer together.

Observations of owl movement within habitat vary. Several observations were made of owls moving up and down riparian vegetation on creeks and the Macquarie River itself (eg. 2B-11-01, 2B-5-04, 1B-11-01, 2B-1-02). In all these cases, no owls were observed or heard away from the riparian zone. Record 3B-7-02 was of three owls moving up and down a 500m stretch of the Macquarie River. Some of these birds also flew out from the river for approximately 300m to the edge of open country but remained within *E. camaldulensis* vegetation.

Two records were made of three owls (3B-7-02, 3B-1-04) in July 2002 and Jan 2004, respectively, potentially representing adult pairs with juveniles from current or previous breeding. NPWS (2003) state that fledged young can be seen with their parents from October to January, which would only account for the January record. Record 2B-1-97, in January 1997, was of a pair of owls that flew out of *E. camaldulensis* forest into adjacent *E. coolabah* open woodland to hunt. One owl was observed carrying a *Mus musculus* back to the *E. camaldulensis* from where they came. This may have been an adult taking prey back to feed young.

Discussion

Habitat

All the records of *N. connivens* in this paper are associated with *E camaldulensis* woodlands or forests. The majority of these records were from riparian vegetation but some floodplain woodlands were also utilised. Records of owls not in *E. camaldulensis* were of birds either flying out of such woodland to hunt in adjacent vegetation (eg. *E. coolabah*, *E. largiflorens*) or of birds in mixed species woodlands with *E. camaldulensis* (ie. with *E. populnea*, *E. largiflorens*). The survey records indicate a consistent pattern of habitat use of *E. camaldulensis* communities west of the Great Dividing Range outside of the box / ironbark forests.

Within NSW, *N. connivens* inhabits open forest and woodland (Ayers *et al.* 1996). Kavanagh *et al.* (1995) described the species' preferred habitat as primarily open woodland or semi-cleared land near creeks and rivers, particularly with one or more species of red gums, that contain a number of large trees for nesting and roosting.

The association with *E. camaldulensis* is supported by Debus (1997) who reviewed 496 records of the owl in NSW. His analysis of records indicates *N. connivens* is most common on the coast in open forests of Forest Red Gum *E. tereticornis*; on the western slopes and plains in box/ironbark/cypress woodlands and on the plains in *E. camaldulensis* woodlands. Surveys conducted from 1994-96 by the National Parks and Wildlife Service (now Department of Environment and Conservation) for the Northern Floodplain Region of NSW only recorded *N. connivens* within riverine woodlands such as *E. camaldulensis*, *E. largiflorens* and *E. coolabah* (Smith *et al.* 1998). Vertebrate fauna surveys conducted by the NPWS for the Darling Riverine Plains Bioregion in 2000-01, obtained nineteen records of *N. connivens*. All of these locations support previous findings on the preferred habitat of the species in this region, namely inland riparian woodland, particularly that containing *E. camaldulensis* (NPWS 2002). Of these Darling Riverine Plain sites, two were located within the lower Macquarie River floodplain. A single barking owl responded to call playback in a linear roadside *E. camaldulensis* / *E. coolabah* remnant near the Macquarie Marshes Nature Reserve, and two birds were dueting from riparian vegetation along the Macquarie River upstream of Warren and hence out of the area considered in this paper (NPWS 2002).

A further three *N. connivens* were recorded by DEC staff in March and April 2004 as part of the Macquarie Marshes Community Biodiversity and Cultural Sites Survey (Andy Mcquie pers. comm. 2005, DEC Coonabarabran). All three records came from owls in *E. camaldulensis* communities, with one from virtually the same location as the record 3B-1-04 in this report and therefore possibly representing the same birds.

Observations suggest that *N. connivens* does hunt away from riparian woodlands in some cases (eg. records 1B-12-96, 2B-1-97) and stays within riparian vegetation in others (eg. records 2B-5-04, 2B-1-02, 2B-2-02, 2B-11-01, 1B-11-01).

All the records made from the watercourses of Sandy Creek, Crooked Creek and Gum Cowal were of owls that appeared to stay within the linear riparian vegetation and not venture out into surrounding communities. In all cases, these creeks have abrupt vegetation boundaries from dense riparian forest or woodland of *E. camaldulensis* to either cleared paddocks or open woodland dominated by *E. populnea.* No owl records were made from *E. populnea* woodland sites surveyed along the floodplain. The sites where owls were foraging away from riparian zones into adjacent woodland were characterised by having no clearing and large intact areas of floodplain vegetation where the tree density gradually lessened from riparian forest / woodland to open woodland on the floodplain.

Nearest neighbour distances and territory estimations

The many examples of owls, including pairs, calling throughout the year support the view that established owl pairs are permanently resident and territorial (Debus 1997).

Nearest neighbour distances ranged from 2 – 5 kilometres. The nearest neighbour measurements assume that the distance between pairs is the spacing that approximates the centre of the bird's territory (ie. the radius). The estimate of the distance covered assumes that the length of watercourse utilised represents the diameter of the owl's territory. In both cases an additional untested assumption is that the owls would utilise all the area between their initial location and half-way to the nearest neighbour on each side, or they utilise all available habitat centred on the length of watercourse traversed. This implies circular territories due to an even spacing of owl families, which is untested and probably unlikely as resources would not be evenly distributed throughout the landscape. NPWS (2003) suggest breeding pairs may be spaced at <1 kilometre to 10 kilometres. In north-eastern Victoria, Taylor *et al.* (2002) studied 20 pairs of owl within 17,000 hectares of box-ironbark forest/woodland. Mean neighbour distances between nests was 4.5 kilometres and the nearest neighbours were 1.8 kilometres apart. During October-December 1999, one female was radio-tracked within a radius of 1km of her nest site and her territory, estimated by minimum convex polygon, was 225 hectares (Taylor *et al.* 2002).

Little is known about *N. connivens* home ranges within the western slopes and plains of NSW. Radio-tracking of a female owl was conducted by Schedvin *et al.* (2001) within the cypress pine – ironbark forest of Goonoo State Forest near Dubbo. They found that the owl covered a total area of 6,000 hectares, with a central area of 4,100 hectares when several of her longer forays were discounted (estimated from 95% minimum convex polygon). Favoured habitat was along drainage lines. Eight owls have been radio-tracked monthly since June 2004 in an ongoing study of *N. connivens* movement patterns in the cypress – ironbark woodlands of the state forests within the Pilliga Scrub. Preliminary territory size estimates are in the order of 2,000 – 2,500 hectares. Territory shape seems to be elliptical rather than circular in all cases. Territories are not aligned to riparian habitats as there are few watercourses present (Rod Kavanagh pers. comm. April 2005, DPI).

Conclusion

Debus (1997) lists the threats to *N. connivens* populations throughout New South Wales as being further clearing for agriculture in inland NSW, compounded by suppression of eucalypt regeneration by grazing, decline of remnant trees in cleared areas, and reduction of prey (decline of small native mammals). Within woodland remnants, nest hollows may also be lost to timber or firewood harvesting and to competition with the feral Honey Bee *Apis mellifera*. All the above threats also apply to the populations in the lower Macquarie River floodplain.

The owl records from the lower Macquarie floodplain region suggest a strong link to *E. camaldulensis* woodlands / forests. This could be due to the relatively high abundance of large tree hollows for nesting and potential prey habitat, and the presence of dense understorey patches of *Acacia* (and possibly willows) for roosting. Owl records suggest that it is the canopy cover of *E. camaldulensis* that is important as records have been made in red gum communities with varying understorey / shrub layers.

Seven of the sixteen records in Table 1, in addition to three recent records by Department of Environment and Conservation, came from *E. camaldulensis* forests downstream from Marebone Weir (approximately 35 km north of Warren) to the Macquarie Marshes Nature Reserve. Outside of this extensive area, *E. camaldulensis* is generally confined to linear riparian strips either side of the tributary creeks and cowals of the Macquarie River. Almost all owl records away from the Macquarie River occurred in riparian strips. These tributary creeks may well be important for dispersal in addition to being sufficient habitat to maintain breeding territories.

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